Procedural sedation for elderly patients by emergency physicians: a safety analysis of 740 patients

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ABSTRACT

Background

The elderly are perceived as a high risk group for procedural sedation. Concerns may still exist regarding the safety of sedation of this patient group by emergency physicians, particularly when using propofol.

Method

We analysed prospectively collected data on patients aged 75 or over, undergoing sedation between October 2006 and March 2017. We used the World SIVA International Sedation Task Force adverse event tool, stratifying identified adverse events according to consensus agreement.

Results

Of 740 consecutive cases (median age 84 years) 571 patients received propofol, 142 morphine and midazolam and 27 other agents. We identified 19 sentinel events: 2 cases of hypoxia, 10 of apnoea (without hypoxia), 5 of hypotension and 2 of both hypoxia and hypotension. We also identified 30 moderate, 41 minor and 7 minimal risk adverse events. There were no adverse outcomes.

Conclusions

We have demonstrated safe sedation practice in this high risk group of patients in this department. A sentinel adverse event rate of 2.6% including a hypoxia rate of 0.5%, with no adverse outcomes sets a benchmark for elderly sedation. We recommend quality pre-oxygenation, an initial propofol bolus of no more than 0.5mg/kg and a robust training and governance framework.

Keywords: governance; anaesthetics i.v., midazolam; anaesthetics i.v, propofol; sedation.

The safe provision of procedural sedation and analgesia is an essential skill required by emergency physicians[1]. Traditional use of benzodiazepine/ opioid combinations has been superseded by propofol in some Emergency Departments (EDs)[2]. Such practice is supported: S*afe Sedation of Adults in the Emergency Department*, a report and recommendations by the Royal College of Anaesthetists (RCoA) and the College of Emergency Medicine[3].

Elderly patients are more likely to be at risk from sedation given that many have co-morbidities, increased sensitivity to sedatives[4] and limited physiological reserve. In a previous safety analysis of 1008 adults sedated with propofol, we found that six of eleven cases with a sentinel adverse event were elderly[5]. In contrast, age was not a factor associated with complications in an analysis of 1402 adult patients in a Scottish ED[6].

Since sedation is a common ED procedure, the UK population is ageing and the perceived sedative risk in this patient group, we explored the safety of our service for the elderly in greater detail, irrespective of sedative agent used.

METHODS

We conducted an observational study using a prospectively collected database of patients undergoing sedation in our ED – one seeing 60 000 patients in 2007, rising to 90 000 in 2016. We used either propofol, morphine and midazolam or on occasions ketamine or 70% nitrous oxide, the latter alone or possibly in combination with other agents. Propofol was given according to our published guideline[7]. This has evolved and the current is illustrated in appx 1. Essentially patients received a 0.5 - 1 mg/kg bolus of propofol after 3 min of pre-oxygenation with a fraction of inspired oxygen (FiO2) as close to 1 as possible. This was provided via a bag-valve-mask attached to high-flow oxygen and was continued until each patient was able to demonstrate adequate ventilatory effort. Smaller additional boluses were used for inadequate or prolonged sedation. Alternatively morphine and midazolam was used with discretion (for example, in the unwell, frail) or according to policy: senior physician unavailable. For all patients with fracture, dislocation or both, IV morphine given by paramedic crews was typically supplemented with further boluses according to pain score and response, before radiological investigation.

We used the American Society of Anaesthesiologists' (ASA) guideline on fasting requirements for elective surgery (adopted by the RCoA). On occasions, we allowed flexibility in clinically urgent cases (e.g. unstable patient requiring cardioversion, joint dislocation with neuropraxia) as previously discussed in a consensus-based clinical practice advisory[8]. We routinely risk assessed each patient's airway, using the respective ASA grading informally. We carefully considered the risk and benefit of procedural sedation, the target depth of sedation and selection of sedative agent(s) selection. Sedated patients were continuously monitored with pulse oximetry, respiratory rate (via transthoracic impedance trace), ECG and non-invasive blood pressure measured every five minutes. We introduced nasal capnography in late 2011. Each sedation episode was recorded on a dedicated electronic database, with emphasis on adverse events (problem, time, intervention, response and time to full recovery).

We retrospectively applied the World SIVA International Sedation Task Force adverse event reporting tool[9] (endorsed by the Royal College of Emergency Medicine) to the database from its inception in October 2006 to March 2017 (cf. our previous analysis[5]: all adult cases from inception to 2012). In addition, one of us cross-examined the original sedation chart for each patient in order to confirm events, detect those not recorded electronically and complete missing data. Three of us scrutinized cases in which an adverse event had been identified and stratified these according to consensus agreement.

We confirm that our research and development directorate deemed that this study did not require patient consent or formal ethical review, as per the governance arrangements for Research and Ethics Committees in the UK.

RESULTS

We identified and analysed 2931 patients. 740 of these were aged 75 years or older. Three were excluded since they had their sedation delivered by anaesthetists. Figure 1 illustrates the proportion of cases that were arbitrarily grouped: 75-79, 80-84 and 85+ years old. The ages ranged from 75 – 101 years (median 84 years). 208 patients were male, 529 female. The clinical indication for sedation is demonstrated (Fig. 2). 571 patients received propofol, 142 morphine and midazolam and 27 other agents. We identified 97 adverse events and stratified in accordance with the SIVA tool 19 of these as sentinel, 30 as moderate, 41 as minor and seven as a minimal risk adverse event. Of the sentinel cases, two related to hypoxia, ten to apnoea (without hypoxia), five to hypotension requiring the need for pressor treatment and two cases related to both hypoxia and hypotension. Five of the 19 cases involved midazolam, 14 propofol. We describe each sentinel case in table 1.The number of sentinel events each year are depicted in Fig 3. The sentinel event rate in each age group is demonstrated in Fig 4. The overall sentinel adverse event rate was 2.6%.

We failed to retrieve the original sedation chart in 70 cases, either because the chart had not been scanned (20), or the incorrect hospital number had been recorded on the database(27) or not recorded at all (23). We included all 70 patients within the analysis, using the evidence recorded within the database and where possible accessing the patients' hospital records. None of these had a sentinel adverse event; four had moderate. The remainder had either lesser or no adverse events.

DISCUSSION

This study suggests that sedation practice for elderly patients in this department is safe. Whilst we recognise that the overall adverse event rate is more than twice that of our previous analysis of sedated adults (2.6 vs 1.1%), the incidence of hypoxia was 0.5% in both studies. This compares favourably with hypoxia rates identified with electronically recorded pulse oximetry during non-cardiac adult anaesthesia of 10.3%[9]. Ten of the 19 sentinel cases in our series had neither hypoxia nor hypotension. There were no adverse outcomes.

On analysis, two particular points are noteworthy:

- As per our previous recommendation[5] a smaller propofol bolus (0.5mg/kg) and smaller subsequent boluses (0.25mg/kg) may have limited or prevented both respiratory and cardiovascular complications. Only three (cases12, 13 and 18) of the 14 sentinel cases given propofol had the doses in line with this recommendation. This likely represents a responsive change in practice from 2013.

- The merit of quality pre-oxygenation (as per propofol protocol) protected the majority of apnoeic patients from hypoxia: nine of the 12 patients meeting the World SIVA definition of apnoea did not become hypoxic.

The number of adverse events per year (Fig 4) appears patternless. Neither is it possible to draw any meaningful conclusions when comparing event rates between propofol and morphine and midazolam. The latter combination may have deliberately been selected for the frail elderly; on deeper analysis all five sentinel events were supervised by a consultant, confounding the notion that these would be more likely with a lone middle grade, a risk factor previously identified by Scottish colleagues[6].

The sentinel event rate in the three age groups (Fig 3) fails to demonstrate a trend; the increased rate in the most elderly group is not statistically significant. The adverse event rate of 2.6% nevertheless endorses caution: robust training and governance is required to support their sedation.

We recognize limitations to our study:

- (likely) poor recording of prolonged apnoea in the database and sedation charts. Propofol typically causes brief apnoea or change in respiratory pattern at onset, and the duration of this may not be accurately timed, especially when expected and not associated with hypoxia due to appropriate use of pre-oxygenation
- intermittent saturation recording could potentially miss significant desaturation. Future study might therefore incorporate continuous electronic saturation data capture
- the possibility of variable reporting of events by staff. However, real time recording of data onto the e-database is mandated in the department and reinforced on annual, open audit as part of the governance framework
- the failure to find and cross-examine the original sedation chart of 73 patients

In conclusion, we have demonstrated safe sedation practice in this high risk group of patients in this emergency department. A sentinel adverse event rate of 2.6% including a hypoxia rate of 0.5%, with no adverse outcomes sets a benchmark for elderly sedation. We recommend quality pre-oxygenation, an initial propofol bolus of no more than 0.5mg/kg (and subsequent doses of 0.25mg/kg) and a robust training and governance framework.

AUTHOR'S CONRTIBUTIONS

G.H.: study design, data analysis and writing first draft of manuscript; A.P.: data analysis and writing first draft; H.G-P.: data analysis and revising manuscript; A.A.: study concept and design and manuscript revision: G.L. study concept and design, data analysis and manuscript revision.

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DECLARATION OF INTEREST

G.L. is the former Airway Lead for the Royal College of Emergency Medicine

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TABLES

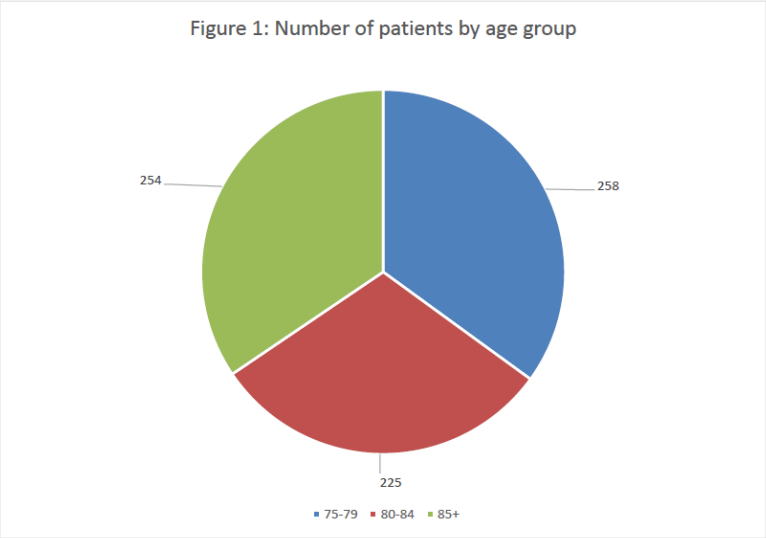
Figure 1: Number of patients by age group
254
258
225
75-79
80-84
85+

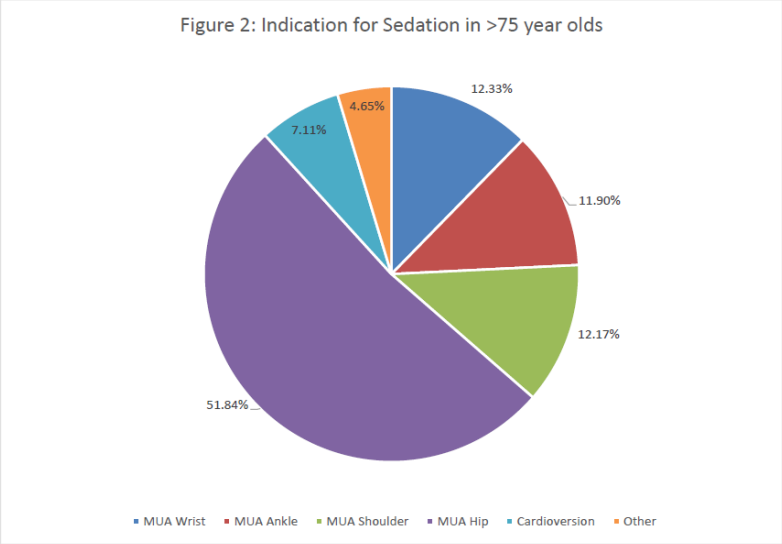
Figure 2: Indication for Sedation in >75 year olds
12.33%
4.65%
7.11%
11.90%
12.17%
51.84%
MUA Wrist
MUA Ankle
MUA Shoulder
MUA Hip
Cardioversion
Other

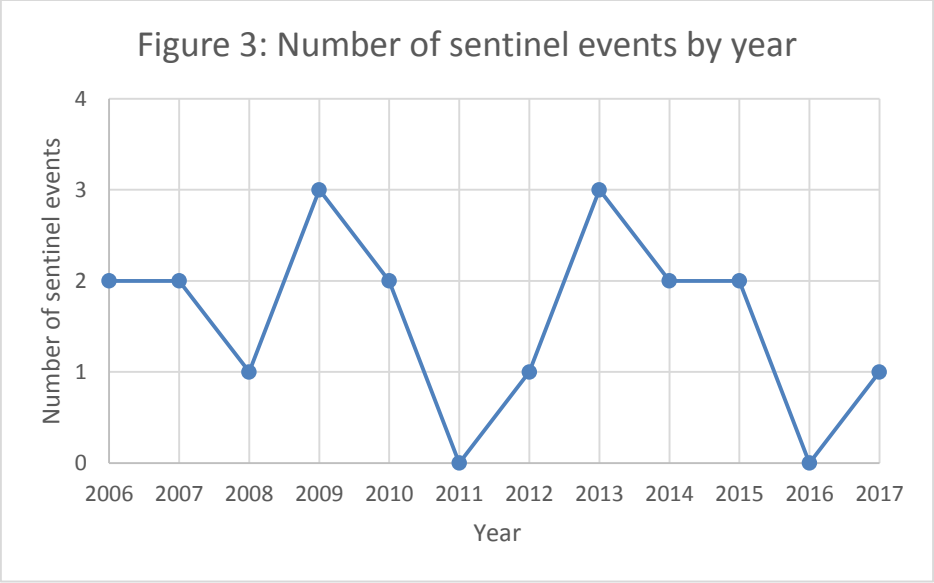
Figure 3: Number of sentinel events by year
Number of sentinel events
0
1
2
3
4
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year

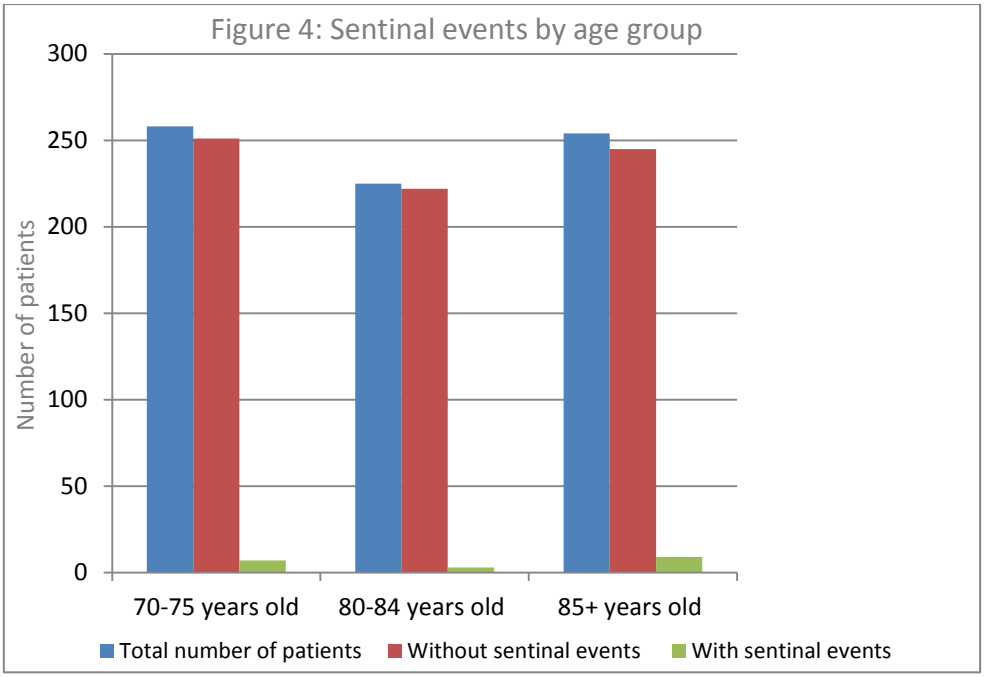
Figure 4: Sentinal events by age group
300
250
200
150
100
50
0
Number of patients
70-75 years old
80-84 years old
85+ years old
Total number of patients
Without sentinal events
With sentinal events

Sentinel Event	Age	Sex	Diagnosis	Co-morbidities /relevant drugs	Pre-hospital analgesia ED analgesia	Pre-procedural crystalloid	Doses of IV sedative agent	Adverse Event	Management
1	84	M	Dislocation of prosthetic hip	Vascular dementia, hypertension (atenolol and frusemide)	Morphine 10mg IV	1000ml	Propofol 1mg/kg	Hypotension 73/58 (baseline 130/70); 'well perfused' recorded	Metaraminol 1mg
2	78	F	Fractured tibia and fibula	Multiple sclerosis, ischaemic heart disease	Oral morphine 10mg Morphine 5mg oral, Morphine 15mg IV	1000ml	Propofol 1mg/kg	Hypotension 78/30 (baseline 125 systolic)	Metaraminol 0.5mg
3	85	F	Fracture dislocation shoulder	Fluid retention (frusemide)	Nitrous oxide, Morphine 10mg IV	Not documented	Propofol 1mg/kg	Hypoxia (Sats 70%)	BVM ventilation < 60s
4	75	M	Fractured elbow	Polymyalgia rheumatica, hypertension (candesartan)	Morphine 10mg oral IV morphine 7.5mg	Not documented	Propofol 1mg/kg	Apnoea >60s	Resolved without need for BVM (no drop in O2 saturation)
5	88	F	Fast atrial fibrillation (120-170bpm) with chest pain	Type 2 diabetes mellitus, hypertension (lisinopril)		250ml	Propofol 1mg/kg initially, then 0.5mg/kg	Hypotension 75 systolic (baseline 170/65)	Metaraminol 0.25mg with prompt response
6	87	F	Dislocation of prosthetic hip	Fluid retention (bendroflumethiazide)	Morphine 5mg IV, nitrous oxide	500ml	Propofol 1mg/kg	Apnoea >60s	BVM ventilation, no drop in O2 saturation
7	77	F	Fractured tibia and fibula	None relevant	IV morphine 20mg	Not documented	Propofol 1mg/kg	Apnoea >60s	BVM ventilation, no drop in O2 saturation
8	76	M	Dislocation of prosthetic hip	None relevant	None	Not documented	Midazolam 5mg bolus	Apnoea >60s	Flumazenil. No recorded drop in O2 saturation

							Fentanyl 50mcg		
9	77	M	Dislocation of prosthetic hip	Hypertension (captopril, amlodipine, atenolol)	Entonox Morphine 10mg	1000ml	Propofol 1mg/kg	Apnoea 3 minutes	Resolved without need for BVM (no drop in O2 saturation)
10	78	F	Dislocation of prosthetic hip	Permenant pacemaker (spironolactone, frusemide)	IV morphine 10mg	1000ml	Propofol 1mg/kg	Hypotension 85 systolic (baseline 120/50)	Metaraminol 0.25mg
11	79	M	Dislocation of prosthetic hip	Ischaemic heart disease (metoprolol)	Not documented Morphine 1-10mg IV (exact dose not recorded)	1000ml	Midazolam 14mg titrated Fentanyl 100mcg	Apnoea >60s	BVM assisted ventilation. No drop in O2 saturation. Naloxone and flumazenil 500mcg
12	89	F	Dislocation of prosthetic hip and stroke	Diabetes mellitus, hypertension, cerebrovascular event (frusemide, lercanidipine, ramipril)	IV morphine 7mg	500ml	Propofol 0.5mg/kg initially, then 0.5 mg/kg	Hypotension 65 systolic (baseline 100/30)	Metaraminol 2mg
13	93	F	Dislocation of prosthetic hip	Atrial fibrillation (digoxin)	Morphine 20mg IV titrated	1000ml	Propofol 0.5mg/kg initially, then 0.5 mg/kg, then 0.5mg/kg	Apnoea >60s with hypoxia (sats 85%)	Airway manouevres and BVM assisted ventilation
14	82	F	Colles fracture and allergy to local anaesthetic	None relevant	None	500ml	Midazolam 2mg	Hypotension 76/55 (baseline 118/65)	Metaraminol 0.25mg and crystalloid challenge
15	88	F	Fractured tibia and fibula	None relevant	IV morphine 15mg, entonox	Not documented	Propofol 1mg/kg initially then 0.5mg/kg	Apnoea 2-3 minutes	Resolved without need for BVM (no drop in O2 saturation)

16	80	F	Shoulder dislocation	None relevant	Morphine 15mg IV	500ml	Propofol 0.5mg/kg initially then 0.5mg/kg	Apnoea 2 minutes	Resolved without need for BVM (no drop in O2 saturation)
17	95	F	Shoulder dislocation	Atrial fibrillation, hypertension, heart failure (atenolol, doxazocin)	None	Not documented	Midazolam 2mg IV	Apnoea >60s	BVM assisted ventilation (no drop in O2 saturation) Flumazenil 150mcg
18	92	M	Ventricular Tachycardia with intermittent chest pain and hypotension 85/61	Coronary artery bypass graft (ramipril, frusemide)	None	500ml	Midazolam 2mg IV	Hypoxia (Sats 82% for >60s), hypotension 73/51	Not noted
19	90	F	Dislocation of prosthetic hip	Permenant pacemaker, hypertension, atrial fibrillation (metoprolol, frusemide)	None	500ml	Propofol 0.5mg/kg, followed by fentanyl 100mcg	Hypoxia (Sats 86%), hypotension 54/40	Airway manouevres, Metaraminol 1mg, Naloxone 400mcg